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Presqu'ile

Annual Report on the Management of Double-crested Cormorants for 2004

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Cover photo: Cormorants at High Bluff Island, Presq'uile Provincial Park
Photo taken by: Ontario Parks staff

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Executive Summary

Between April 22 and September 28, 2004 Presqu'ile Provincial Park implemented the second year of a management program to reduce the park's population of Double-crested Cormorants *(Phalacrocorax auritus)*. This was in accordance with the Management Strategy for Double-crested Cormorants (Ontario Parks, 2002), which was amended in 2004. The goal of the program is to deal with cormorant impacts on park vegetation, terrestrial habitat, and other bird species (Ontario Parks, 2000b).

In 2003, cormorant management activities occurred only with the tree-nests of the western woodland of High Bluff Island, and the ground colonies on Gull and High Bluff Islands; the eastern woodland and other wooded areas of High Bluff Island were not managed. In 2004, management was carried out on ground-nesting cormorants on Gull Island and ground and tree-nesting cormorants throughout High Bluff Island, including culling of tree-nesting adult cormorants. This activity was in accordance with the 'Amended Management Strategy for Double-crested Cormorants at Presqu'ile Provincial Park' (Ontario Parks, 2004).

The following methods were employed to meet the objectives of the management strategy:

1) oiling eggs in ground-nests (2003, 2004)
2) removal of nests from trees (2003, 2004)
3) culling of adult cormorants from tree-nests (2004)
4) disturbance of post-breeding season roosts (2004)
5) creation of artificial ground-nesting habitat (2004)
6) planting of trees (2004)
7) monitoring of non-target species (2003, 2004)

In 2004 a total of 2,098 nests was removed from trees using forestry poles. Mineral oil was applied to a cumulative total of 26,311 eggs (from 3,284 ground-nests). 6030 adult cormorants were culled from tree-nesting locations between May 06 and June 07, 2004. Roost disturbance was conducted every other day from August to the end of September. Approximately 1000 square metres of artificial ground habitat was created and trees were planted to initiate habitat rehabilitation.

The carcasses of culled cormorants were disposed of in a composting facility. The site location, design and operations of this facility were determined by the Ontario Ministry of the Environment in accordance with a provisional Certificate of Approval to operate a waste disposal site.

All eight species of non-target colonial waterbirds produced successful broods in 2004. The two tree-nesting species in closest proximity to the majority of management activities, Great Blue Heron (*Ardea herodias*) and Great Egret (*Ardea alba*), produced the highest number of nests and offspring ever recorded at Presqu'ile Provincial Park.

The number of nests counted for the third tree-nesting species, Black-crowned Night-Heron (*Nycticorax nycticorax*) was within the normal range recorded for this species at Presqu'ile Provincial Park. Nest counts for the five ground-nesting colonial waterbird species at Presqu'ile were also within the normal ranges (details in Appendix A).

At the end of the breeding season, the number of successful cormorant nests had declined 21% from 2003 and 43% from 2002 (the last year in which management did not occur).

Background Information

Double-crested Cormorants first colonized the Great Lakes in the early 1900s. The first known nesting colony was found in western Lake Superior in 1913. By 1945, Double-crested Cormorants (hereafter referred to as cormorants) had established colonies as far east as the St. Lawrence River in the Great Lakes Basin (Weseloh et al., 1995). Recently, cormorant populations have increased in Ontario from a low of about 120 nesting pairs in the early 1970s to 115,000 nesting pairs in 2001 (Ontario Parks, 2000a).

Cormorants first began nesting at Presqu'ile in 1982 with a single tree-nest on Gull Island. Since then, cormorant nesting has spread to the adjacent High Bluff Island and numbers have risen steadily to a peak of 12,082 nests in 2002. As a result of the tree-nesting activity of cormorants, all trees on Gull Island have been killed, most super-canopy trees on High Bluff Island have been killed and the remaining mid and lower level vegetation on both islands are threatened (Koh and Carr, 2003).

In accordance with the direction in the Presqu'ile Provincial Park Management Plan (2000), Ontario Parks prepared the 'Management Strategy for Double-crested Cormorants at Presqu'ile Provincial Park' (Ontario Parks, 2002). The park management plan states that the goal of the strategy is to deal with cormorant impacts on specific park values (vegetation, terrestrial habitat, and other bird species).

The strategy was first implemented in 2003 and active management continued in 2004. The results of 2003 management are summarized in the Annual Report on the Management of Double-crested Cormorants for 2003 (http://www.ontarioparks.com/english/planning_pdf/pres_annual_report.pdf). In 2004, the Presqu'ile cormorant management strategy was amended to allow nest removal in all remaining woody vegetation on both Gull and High Bluff Islands and to allow for the culling of adult cormorants from tree-nesting locations.

In 2002, the last year in which no management occurred at Presqu'ile, the Presqu'ile colony constituted approximately 40% of the Lake Ontario population. In 2004, after two years of management, the Presqu'ile colony had a total of 6940 nests (Table 1). This represents approximately 24% of the Lake Ontario population. This report summarizes the results of cormorant management activity at Presqu'ile Provincial Park in 2004.

Methods

Management activities were conducted on High Bluff Island and Gull Island at Presqu'ile Provincial Park.

Site description

High Bluff Island (38.16 ha) lies 2 km southwest of the Presqu'ile peninsula and is adjacent to Gull Island (7.25 ha). High Bluff Island is a low, essentially flat limestone outcrop that has a thin mantle of lacustrine sands and clays at its interior, shingle beach at its periphery, and remnant shingle beach at its interior. Gull Island is an exposed shingle and gravel bar expanding towards the peninsula (Figure 1).

High Bluff Island supports two major woodlands: the western woodland (8.75 ha), and the eastern woodland (2.88 ha). In recent years, both woodlands have suffered serious degradation as a result of cormorant nesting activity. In 2003, the focus of the management program was in the western woodland. In this area, most super-canopy trees have died and many have fallen over but the mid-canopy and lower vegetation remains relatively intact. In 2004, management activities were expanded to include the eastern woodland and other areas of woody vegetation on the island.

Mature Sugar Maple (*Acer saccharum*), Red Oak (*Quercus rubra)* and Black Maple (*A. saccharum ssp. nigrum*) make up the dominant tree cover in the western woodland. The eastern woodland is dominated by White Ash (*Fraxinus americana*), White Cedar (*Thuja occidentalis*), Crack Willow (*Salix fragilis*) and White Birch (*Betula papyrifera*). Trees are found scattered throughout much of the island's interior, as well in successional fields and thickets. Provincially significant species on the islands include Bushy *Cinquefoil (Potentilla paradoxa*, S3)* and Smith's Club-rush (*Schoenoplectus smithii*, S2?)* and the regionally rare Black Maple (*Acer saccharum* ssp. *nigrum*, S4?)*. Blaney (1997) considered the woodland on the island significant due to the age of the trees, the uncommon species association, and the rarity of mature forest on Lake Ontario islands.

At present, cormorants nest on the ground on Gull Island (they formerly nested in trees on the island which have since died and fallen). In recent years they have also nested in the remaining shrub on Sebastopol Point of Gull Island. On High Bluff Island cormorants nest both in woody vegetation (trees and shrubs) and on the ground.

Figure 1. High Bluff Island in the foreground, Gull Island in the background.

* See Appendix 1 for explanation of species ranking

Management Activities

Management activities at Presqu'ile occurred from April 22 to September 28, 2004. These activities can be grouped into four classes of actions; i) cormorant management, ii) vegetation monitoring / management, iii) non-target species monitoring and iv) companion science.

Cormorant Management

Different management techniques that can be used to reduce the negative effects of cormorants on vegetation generally fall into two categories; i) immediate vegetation benefits through the prevention of cormorant nesting, and ii) longer term vegetation benefits through a reduction in cormorant breeding and recruitment. Management at Presqu'ile Provincial Park employed a combination of techniques to affect short and long term impacts to the cormorant population and associated benefits to the vegetation on High Bluff Island. Nest removal and culling have immediate benefits to vegetation by preventing nesting and thereby reducing tree damage for nesting and the deposition of guano. Disturbance also provides immediate benefits by reducing guano deposition. Egg oiling and culling provide longer term benefits by reducing population recruitment and therefore the size of the breeding population in the future.

Egg oiling. On both islands, eggs of ground-nesting cormorants were treated with white mineral oil (Daedol 50 Waterbird Control Oil), under research permit number 22-RP-04 as issued by Health Canada's Pest Management Regulatory Agency. Backpack-style agricultural sprayers were used to deliver the oil (Figure 2). Each sprayer carried 12 L of oil. Hearing protection and full-face respirators with NIOSH Filters AM/CD/FM/HC/HFI(ESC.)/MA/OV/SD (part 755c) were worn by all staff. All nests were identified and marked prior to oil spray application. One person followed the oil sprayer to document the number of treated eggs, number of treated nests and number of unoccupied nests (nests without eggs). Nests containing eggs were oiled once a week on both islands until mid-June and bi-weekly from mid-June until early July.

Figure 2. Oiling of cormorant ground-nests.

Nest removal. In 2004, 2098 nests were removed from trees in all wooded areas of the Presqu'ile Islands (Figure 3a, 3b), including the shrub on Gull Island. Forestry poles (square cross-sectioned fibreglass poles in 8-foot (2.46 m) sections) were the primary tool used to knock nests down from trees. As in 2003, high-level nests that required 8 to 12 sections of poles (approximately 22.5 m to 27.7 m from the ground) required significant amounts of time and effort to remove. Many nests were beyond the reach of forestry poles. For detailed information on nest removal techniques refer to the 2003 annual report (http://www.ontarioparks.com/english/planning_pdf/pres_annual_report.pdf).

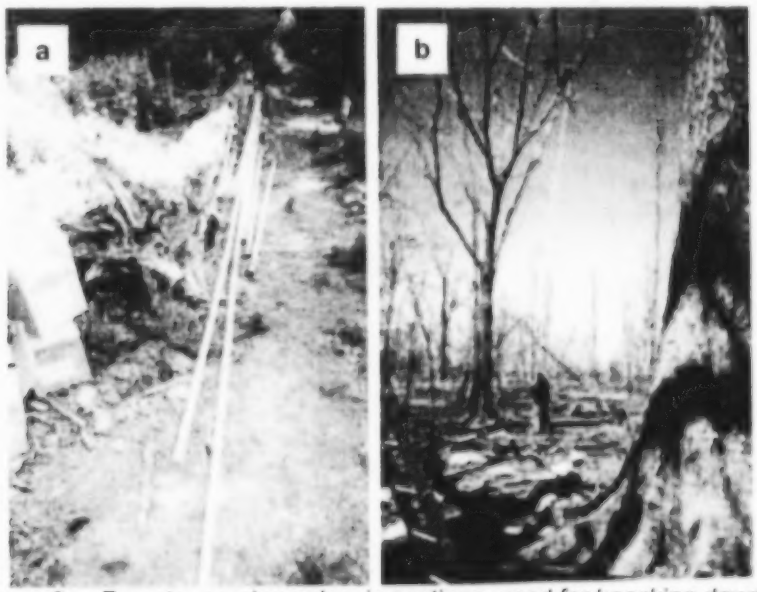

Figure 3a. Forestry pruning poles, in sections, used for knocking down nests
3b. Poles in use for nest removal of a nest on High Bluff Island.

Culling. Culling occurred on thirteen separate days between May 06 and June 07, 2004. Cormorants were shot with .22 caliber rifles fitted with 4 power scopes. Up to six shooters operated in the field simultaneously. Each shooting event took approximately one hour to complete. Shooters would withdraw from the colony for at least several hours, after which another shooting event could take place dependent on factors such as time of day, weather conditions and bird behaviour. Spotters were stationed to ensure public safety. Whenever culling activity was conducted an observer of non-target species accompanied the shooters.

A variety of techniques were developed to reduce disturbance to the non-target heron species during culling activities. These include:

1) Minimizing time spent within the woodlands during cull days. Shot birds were left on the ground until the day's end and all available staff were utilized in the pick-up to minimize the time required. An all-terrain vehicle and trailer were also utilized to ensure the shortest possible pick-up period.
2) Minimizing foot traffic on the island. If culling or pick-up activity was not occurring staff were restricted to either the base camp or composter locations. When traveling between these sites staff traveled as a group along a marked path positioned to minimize potential disturbance to the bird colonies.

3) Allowing at least several hours to elapse between cull periods. The goal of these breaks was to allow non-target species a chance to return to their nest-building and incubation duties.
4) Delaying culling in the western woodland until late-May. This was done to allow the high concentration of non-target heron species located there an opportunity to proceed well into their nesting cycle before any management-related disturbance occurred.
5) Ensuring the sound projected from firearm muzzles was not in alignment with non-target heron species. It was noted that if the direction of muzzle sound was carefully controlled these species often would not fly during shoot periods.

Carcass disposal. At the end of each cull-day the carcasses were collected and delivered to a composting facility on High Bluff Island. To minimize the time and potential disturbance to non-target species within the colony an all-terrain vehicle fitted with a trailer was used to transport carcasses to the composting facility. The site location, design and operation of this facility were determined by the Ontario Ministry of the Environment in accordance with a Provisional Certificate of Approval to operate a waste disposal site (Number 6109-5YJSYF) (Figure 4).

Figure 4. Composting facility on High Bluff Island.

Roost Disturbance. From the beginning of August until the end of September, cormorants were discouraged from roosting in live woody vegetation on High Bluff Island. This was attempted through the presence of humans within these areas (both walking and riding an all-terrain vehicle), scarecrows and noise-making devices (Figure 5). Roost disturbance generally occurred every other day.

Figure 5. Scarecrows and staff presence in roosting areas to discourage cormorants from roosting.

Creation of Artificial Ground-nesting Habitat. In 2003, it was noted that an area used in the mid 1990s as a research site (Caspian Tern immune suppression research) was favoured by ground-nesting cormorants. This area was defined from its surroundings by one-metre tall wooden stakes that had once been driven in to the ground to support a low fence. Although the fence material had been removed a grouping of cormorant nests had developed within the area defined by the fence posts. With the goal of attracting tree-nesting cormorants to ground sites a grid of stakes was placed in an area approximately 50 m by 20 m adjacent to a ground-nesting site on High Bluff Island. The stakes were driven in to the ground with a spacing of 1 m from adjacent stakes. Dummy nests procured from nest removal activities were also placed at this site (Figure 6).

Figure 6. Wooden stakes and "Dummy Nests" were used in an attempt to lure tree-nesting cormorants to ground sites.

Vegetation Monitoring / Management

Tree Planting. A trial planting of trees on High Bluff Island was attempted in the autumn of 2004. The planting stock originated from the park's native tree nursery where trees are grown from seeds collected at Presqu'ile. The trees were planted in late-September to ensure maximum survival. Planted trees were over 2 m in height to discourage browsing by White-tailed Deer (*Odocoileus virginianus)*. Only species currently growing on High Bluff Island were used.

Vegetation Surveys. A vegetation survey was completed for the High Bluff Island woodlands in the fall of 2004. The purpose of the survey is to determine the condition of the vegetation and the rate and direction of change of woody vegetation health, and if possible, determine the effects of 2004 cormorant management actions. Vegetation assessment followed the methods of previous surveys (Carr and Koh, 2001; Koh and Carr, 2003). The surveys assess leaf loss, crown dieback and other factors to determine the health of super and mid-canopy trees and the health of ground cover vegetation.

Non-target Species Monitoring

Non-target species were monitored throughout the management periods to minimize disturbance from management. These non-target species fall into two categories, heron species that nest in woody vegetation and colonial gull and tern species that nest on the ground. The non-target heron species include: Great Egret (*Ardea alba)* (GREG), Great Blue Heron *(Ardea herodias)* (GBHE) and Black-crowned Night-Heron (*Nycticorax nycticorax)* (BCNH). The colonial ground-nesting species on Gull and High Bluff Islands include: Ring-billed Gull *(Larus delarawarensis)*, Herring Gull (*Larus argentatus)*, Great Black-backed Gull (*Larus marinus)*, and on Gull Island only: Common Tern (*Sterna hirundo)* and Caspian Tern (*Sterna caspia)*.

Heron Species

Regular monitoring of the three heron species began on April 22 and concluded on July 22, 2004. One staff person was dedicated to the monitoring of these species. Monitoring was conducted every management day in the morning before other staff arrived on the island, during culling activities and again after the day's management activity concluded. Since each of the three species of interest respond differently to monitoring activity, a different procedure was developed for each species.

Great Egret. All GREG nests were observed five days a week with binoculars and spotting scopes (on cull days and non-cull days) from a series of lookout stations. These stations were located across the island and were arranged so that when in use or being accessed, there was no disturbance to the GREGs.

Great Blue Heron. GBHEs were divided into two monitoring groups: a bimonthly survey of all nests and a sample group of 29 nests that was monitored daily. The sample group represented nests from five different nesting areas:

1) east woodland core
2) west woodland core
3) periphery of east woodland
4) periphery of west woodland
5) fencerows

The sample group of 29 GBHE nests were observed daily either from the GREG observation stations or while in transit between each GREG observation station. Twice a month, all GBHE nests were monitored by entering the colony and carefully noting the status of each nest. This

survey was done only on a bimonthly basis to minimize the disturbance associated with accessing and observing all heron nests.

Black-crowned Night-Heron. BCHNs are the species most sensitive to potential monitoring disturbance. With the exception of nests on Gull Island, their nests were well concealed within thick Choke Cherry (*Prunus virginiana*) groves preventing the use of spotting scopes and binoculars for monitoring. Nest counts would require traveling through these groves, which would result in unnecessary disturbance to the birds (e.g. startled adult birds can knock out their eggs and startled chicks may also jump from their nests). To address these concerns the monitoring of the BCNHs was limited to three visits in 2004. The purpose of these visits was to quickly ascertain the status of nests, not to count eggs or chicks.

To address a concern about roosting cormorants on Sebastopol Point during cull periods, a boat was anchored off Sebastopol Point. This boat was placed such that it prevented cormorants from roosting but had no effect on the incubating BCNHs.

Heron Roost Monitoring. In an attempt to determine if disturbance of roosting cormorants was having an impact on roosting herons, observations of herons leaving and returning to High Bluff Island were made on four separate evenings, two during disturbance (September 20th and 28th) and two during non-disturbance (September 21st and 22nd).

Over a series of ten minute intervals, the observer recorded the number of GREGs and GBHEs traveling to or from High Bluff Island. Monitoring began approximately 50 minutes before sunset and ended approximately 30 minutes after sunset. Observations were conducted from the northeast tip of High Bluff Island (2 nights) and the northeast tip of Gull Island (2 nights).

Cormorant roost disturbance occurred between 5:30 and 6:00 pm by walking or driving an all-terrain vehicle through known cormorant roost areas. The heron observer noted all heron movement to or from High Bluff Island (Figure 7).

Figure 7. Harassment of a known cormorant roosting site. On four separate dates during the harassment period observations were made to determine if roosting herons were being impacted by harassment activities.

Colonial Ground-nesting Species

The five species of ground-nesting colonial waterbird species were monitored periodically in 2004 by Ontario Parks and Canadian Wildlife Service staff. Monitoring activities included nest, egg and chick counts.

Companion Science

Culling of adult cormorants provided an opportunity to conduct a number of complimentary studies related to cormorant biology. These include:

1) Stomach contents sampling
2) Sexing of birds by dissection
3) Weighing of culled birds
4) Collection of cloacal swabs for viral analysis (e.g. West Nile Virus, Avian Influenza, Newcastle Disease)
5) Blood sampling for serology tests

With the exception of blood sampling, all sampling was conducted by project staff. This occurred immediately post-culling and prior to the birds being composted.

Birds were initially weighed using an Extech Digital Hanging Scale. After weighing, the birds were swabbed in the field with Viral Culturettes (TM) made by Becton Dickinson, which contain one rayon-tipped swab and one ampule of 0.5 mL modified Hanks balanced salt solution (Figure 8). These swabs were placed in cooler packs and immediately shipped to the Canadian Co-operative Wildlife Health Centre (CCWHC) at the University of Guelph, Ontario.

Stomachs and their contents were removed, bagged, labeled and frozen for later analysis by the Tunison Laboratory of Aquatic Science, Great Lakes Science Centre, U.S. Geological Survey. This was done to identify what cormorants were eating. Sexing by visual inspection of the bird's gonads occurred after stomach removal.

Blood sampling occurred in the field immediately after birds were culled to ensure fresh samples. This was accomplished by drawing blood via a 23 gauge needle and syringe from the heart. Between 2 to 10 ml of blood was taken from each bird. Staff from the CCWHC conducted blood sampling procedures and transported samples to Guelph for analysis.

Figure 8. Collection of cloacal swabs for viral analysis.

Results

In June of 2004 a total of 6940 cormorant nests were counted at Presqu'ile. This is a decline of 20% since 2003. The number of cormorant nests has declined from 12,082 nests in 2002 (the last year prior to management) to 6940 nests in 2004 (a 43% decline) (Table 1).

Table 1. Double-crested Cormorant Nesting at Presqu'ile, 2002 to 2004

Site	Nest Location	Number of Nests by Year		
		2002	2003	2004
High Bluff Island	tree	6893	4631	3656
	ground	3491	2948	1683
Gull Island	ground	1698	1117	1601
Total	tree	6893	4631	3656
	ground	5189	4065	3284
	all	12082	8696	6940

Cormorant Management

Egg oiling. In 2004, with a single backpack sprayer in operation, it took an average of one half-day to treat eggs on High Bluff Island and a half-day for Gull Island. A total of 26,311 eggs from 3,284 ground-nests was treated with oil on both islands (Table 2). Egg oiling successfully prevented all eggs from hatching in ground-nests.

Nest removal. In 2004, a total of 2,098 nests was removed from trees on High Bluff Island (Table 2). The success of removing a nest using forestry poles depended largely on nest height. Mid-level nests demanded the most attention due to their relative abundance. In 2004, 6% of the nests removed by forestry poles (126 of 2098 nests removed) contained dead birds that had been previously culled. 68% of the nests (n=86) containing dead birds were active, containing one or more fresh eggs. Eight active nests contained two dead birds, indicating that the occupants of these nests had been culled twice before a third pair had claimed these nests and initiated incubation.

Table 2. Double-crested Cormorant Management Actions at Presqu'ile

Activity	Year	
	2003	2004
eggs oiled	28648	26311
nests removed	3980	2098
adults culled	0	6030

Culling. A total of 6030 cormorants were culled at Presqu'ile on thirteen separate days between May 06 and June 07, 2004.

Carcass disposal. The carcasses of the culled birds were placed into a composting facility and, with the exception of the larger bones and primary feathers, fully decomposed.

Roost Disturbance. Roost disturbance by staff presence (both walking and riding an all-terrain vehicle) and creation of scarecrows showed some success. Noise-making devices (air horns) proved to be ineffective at disturbing cormorants. Disturbed cormorants were observed leaving the treated areas and either completely leaving High Bluff Island or roosting on the ground on the Island's eastern or western extremities.

Creation of Artificial Ground-nesting Habitat. The artificial ground-nesting habitat was not used by cormorants in 2004. Vegetation growth covered the stakes and the area became unsuitable for cormorant nesting. A second site in more suitable habitat was created later in the summer after the breeding period and so was not used.

Vegetation Monitoring / Management

Tree Planting. Approximately 40 deciduous trees of a mixture of White Elm (*Ulmus americana*) and White Birch (*Betula papyrifera*) were planted on High Bluff Island. Survival rates will be determined in the spring of 2005.

Vegetation Surveys. The full analysis and results of the 2004 vegetation survey were not available at the time of preparation of this document. However, it is known that the health of the western woodland has declined significantly since 2002, and it is too early to detect a response from management (S. Koh, pers. comm.). The results from 2004 surveys will be compared to previous vegetation surveys.

Non-target Species Monitoring

Herons

All three non-target heron species had successful breeding seasons. Two of the non-target species, GREG and GBHE had record numbers in 2004. Successful GREG nest numbers doubled and successful GBHE nests increased by 52%. The third species, BCNH, declined somewhat from 2003 but the number of nests is still within the normal range for Presqu'ile. Observations of heron species are listed in Appendix 1.

Great Egret

Quantitative:

A maximum of 10 pairs of GREGs were observed on the island at any one time. Ten successful nests produced 26 young (Table 4). One nest fledged four young, four nests each fledged three young and five nests each fledged two young. Four nests were clustered in the western woodland, three nests were located in a Choke Cherry grove in the eastern woodland and three nests were interspersed within the large BCNH colony along the northern shoreline of High Bluff Island.

Qualitative:

All GREG nests built in the canopy were taken over by cormorants. Two such takeovers were observed by staff. Upon leaving their nests a GREG pair would return to find it occupied by a cormorant. After a few aggressive bill thrusts by both species the GREGs would depart and not return to that nest. GREGs fared much better in low-level nests in shrubby vegetation, 6' to 10' off the ground.

Due to their large size, distinctive colouration and low numbers, Presqu'ile's GREGs were relatively easy to monitor. The 10 successful nests likely represent the entire GREG population at Presqu'ile.

GREGs were constantly abandoning nests and building new nests in 2004. This activity occurred mostly when staff were not on the island. Twenty-nine known nesting attempts

(including the 10 successful nesting attempts) were recorded during the management season. Only three of the failed attempts were observed on a day in which culling activity occurred. These occurred on the first day of shooting and techniques were subsequently modified (see Methods section).

Aggressive interaction between GREGs was observed on several occasions. During some of these conflicts, eggs were observed falling from the nests. The ferocity and duration of these interactions was notable considering the mediocre effort put forward when GREGs interacted with cormorants.

Great Blue Heron

Quantitative:

Thirty-eight nests were successful, producing 75 young (Table 4). These nests were spread between the east and west woodlands and adjoining fencerows. A sample of 29 nests were observed daily. Eleven of these nests successfully produced 17 young and 15 nests were taken over by cormorants during periods when staff were not on the island. The three remaining nests of the sample of nests were taken over on days while management was occurring on the island. These three nests were all small nests.

Qualitative:

Unlike GREGs, adult GBHEs and their young were observed effectively driving off cormorants attempting to usurp their nests. Heron nests located within the cores of the nesting colonies were more likely to succeed than peripheral nests.

The maximum count for the GBHE population occurred May 3rd when there were 63 active nests (active nests were defined as a discernable collection of sticks of any size attended by accompanying herons). There were relatively few cormorant tree-nests at this time. By late May and early June, when cormorant nesting was at its peak, the number of GBHE nests had declined to 38 active nests (Table 4).

Black-crowned Night-Heron

Quantitative:

Fifty-nine BCNH nests were counted in 2004 (Table 3). Due to the potential of observer disturbance it was decided to minimize time spent within BCNH colonies. As such, nest counts were conducted, but it was deemed unacceptable to attempt to ascertain nest productivity.

Qualitative:

The BCNH nesting population in 2004 was down from 2003 (80 nests in 2003, 59 in 2004) (Table 3). This may be the result of pressures from an increasing GREG colony and the roosting pressure of cormorants on Sebastopol Point during cull periods. Four BCNH nests were observed being taken over by GREGs.

Table 3. Nest Count Data for three Non-target Heron Species from 1998 to 2004 at Presqu'ile

	Number of Nests Observed						
Species	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Great Blue Heron	1	5	14	NA	12	38	63
Great Egret	0	1	2	3	3	5	10
Black-crowned Night-Heron	NA	NC***	NC	NA	73*	80*	59

* Canadian Wildlife Service data

** Not available (NA)

*** Not counted (NC) to avoid disturbance to Great Blue Herons and Great Egrets

Table 4. Nesting Success of Non-Target Heron Species at Presqu'ile, 2003 and 2004

	Maximum Nest Count		Number of Successful Nests		Number of Fledged Young		Number of Fledged Young per Nest	
Species	2003	2004	2003	2004	2003	2004	2003	2004
Great Blue Heron	38	63	25	38	37	75	1.48	1.97
Great Egret	5	10	4	10	10	26	2.5	2.6
Black-crowned Night-Heron *	80	59	Not known	Not known	Not known	Not known	Not known	Not known

* Black-crowned Night-Heron nest productivity is not known. This is due to the extreme sensitivity of this species to disturbance. Nests were counted only three times during the breeding season. Nest contents were not closely examined - a nest was deemed active as soon as it was determined if it contained eggs or chicks.

Heron Roost Monitoring. During the four heron roost monitoring observation dates, no GREGs were seen leaving the island. An average of 2.0 GREGs were seen returning to High Bluff Island to roost during the four observation dates. An average of 4.0 GREGs were seen arriving on High Bluff Island during cormorant roost disturbance days and 0.5 GREGs were seen arriving on non-roost disturbance days.

An average of 0.5 GBHE were seen returning to High Bluff Island to roost over the four observation days. An average of 1.0 GBHE returned to High Bluff Island during cormorant roost disturbance days and no GBHE were seen returning to High Bluff Island during non-roost disturbance days.

An average of 1.5 GBHE were seen departing High Bluff Island over the four observation days. An average of 3.0 GBHE were seen departing High Bluff Island on cormorant roost disturbance days and no GBHE were seen departing High Bluff Island on non-roost disturbance days.

All herons and egrets that left High Bluff Island did so a minimum of 30 minutes after roost disturbance activity had been completed. All herons and egrets that returned to High Bluff Island did so between 30 and 90 minutes after roost disturbance activity had been completed. Although these observations showed no clear patterns, the heron observer saw no GREG or GBHE leaving the island during disturbance periods.

Colonial Ground-nesting Species

The ground-nesting non-target colonial waterbird species were largely unaffected by management activities because of the distant location of their nesting areas relative to the majority of cormorant management work. The only time when management staff entered the ground colonies was during cormorant egg-oiling activities. These short-duration visits resulted in minimal disturbance. Nesting success data for the ground-nesting species are listed in Appendix 1.

Companion Science

With the opportunity to examine a large number of cormorant carcasses a variety of companion science projects were undertaken in 2004. These include:

1) Stomach contents sampling - 540 birds
2) Sexing of birds by dissection - 540 birds
3) Weighing of culled birds (see Appendix 2) - 260 birds
4) Collection of cloacal swabs for viral analysis (e.g. Avian Influenza) - 434 birds
5) Blood sampling for serology tests - 100 birds

Of the 540 cormorants that were sexed a total of 395 were male and 145 were female. The male:female sex ratio was 2.7 males per every female culled.

In October 2004, the cloacal swabs collected on High Bluff Island were examined by the Avian Virology Laboratory at the Animal Health Lab, Ontario Veterinary College. Of the 434 swabs collected, 360 had been tested at the time of preparation of this report. All tested swabs have been negative for avian influenza.

Laboratory test results of the stomach content sampling and blood-serology viral analysis were not available at the time of the preparation of this report.

Eighteen of the 6030 cormorants culled were banded birds, and four of these birds were banded at Presqu'ile. The data collected from these bands is presented in Appendix 3. The average age of the banded birds was 8.4 years old, with the average age of the Presqu'ile birds being 2.8 years and the non-Presqu'ile birds being 10 years. The oldest of these birds was 16 years old.

Discussion

Cormorant management activities on Presqu'ile's islands have lead to a substantial decline in the number of cormorants nesting at Presqu'ile. Since 2002, the last year in which management did not occur, the park's cormorant nesting population has declined from 12,082 nests in 2002 to 6,940 nests in 2004 (Table 1). This represents a decline of 43%.

Cormorant tree-nests declined by 47% from 6893 nests in 2002 to 3656 nests in 2004. The total number of cormorant ground-nests on both islands declined by 37% from 5189 nests in 2002 to 3284 nests in 2004 (Table 1).

On High Bluff Island, the ground-nest colony declined by 52% from 3491 nests in 2002 to 1683 nests in 2004. On Gull Island, the number of ground-nests decreased by 6% from 1698 nests in 2002 to 1601 nests in 2004 (Table 1).

Compared to 2003, a 43% increase in ground-nesting cormorants was noted on Gull Island in 2004. A large number of these birds may have been displaced from the nearby eastern woodland of High Bluff Island (where a 47% decline in nesting occurred) by the culling and nest removal activities that occurred there in 2004. A similar shift was noted in 2003 when nest removal activity occurred only in the western woodland of High Bluff Island. In 2003, the number of cormorants nesting in the eastern woodland increased by 58% - this increase may have resulted from displaced birds from the western woodland relocating to the eastern woodland. From a management perspective these movements indicate that it may be possible to redirect at least a portion of the park's nesting cormorants out of managed tree and shrub nesting sites to other locations, ideally to the ground, where damage to woody vegetation associated with nesting activity is minimized and these birds can then be managed by egg oiling.

The 2003 management program resulted in a decline in the overall number of nests due to nest removal. However adult cormorants deprived of the opportunity to nest still remained a part of the overall population - potential breeders in future years. This is problematic since these birds continue roosting and re-nesting after the removal of their nests, resulting in the on-going accumulation of their guano and vegetation damage by nest-building activities. Since cormorants are long-lived birds, even if reproduction is completely eliminated the vegetation-damaging effects of adults attempting to re-nest will remain into the foreseeable future. The culling of adult birds as implemented in 2004 is the only known, practical way to eliminate the vegetation-damaging effects of adult cormorants.

Cormorant Management

Egg oiling has proven to be an effective tool to reduce the production of young from the ground-nesting colony, as all eggs were treated relatively quickly and the technique was successful in preventing hatching. Egg oiling tricks adults into continuing to incubate eggs, thus pre-occupying their time for long periods and eliminating recruitment. However, predation of cormorant eggs by gull species was substantial, and when predation occurred, cormorants would re-lay their eggs (in the same nests). Cormorant egg-laying also naturally occurs over a prolonged period of time. For these reasons it was necessary to continue oiling nests throughout the season.

Experience elsewhere has shown that egg-oiling should be considered a long-term method of reducing avian populations. Egg-oiling only reduces recruitment of young into the population, and the adult birds remain within the population and continue to attempt breeding. The effects of these birds remain, since the guano produced by these unsuccessful breeders continues to affect vegetation used for nesting and roosting. Another factor to consider is the fact that a

significant proportion of Presqu'ile's nesting cormorants do not nest on the ground. In 2004 53% of the park's nesting cormorants were tree-nesters, inaccessible to oil-spraying equipment. Due to aforementioned reasons egg-oiling should be considered as only a part of the overall cormorant management scenario for Presqu'ile.

As in 2003, a significant number of high level nests remained beyond the practical reach of removal by forestry poles in 2004. These nests were left behind in favour of the removal of more accessible mid and lower level nests. Removal of high-level nests was an extremely slow process and required a high degree of effort. A method of dealing with these high-level nests is required to provide maximum ecosystem protection

In 2004, it was noted that the western woodland of High Bluff Island was not intensely used as a nesting area until the third week of May. This was despite the arrival of large numbers of nesting cormorants in the eastern woodland in early May and the culling activity that was occurring in the eastern woodland at that time. This reluctance of cormorants to nest in the western woodland may be due to the removal of cormorant nests from this area in 2003. The same phenomenon was observed during 2003 in areas of the western woodland completely cleared of cormorant nests (Ontario Parks, 2004). Cormorants were reluctant to return to the areas completely cleared of nests, favouring areas where nests had been left behind.

Observations of non-target bird species behavior suggest that the mere presence of humans within the breeding colonies causes a disturbance. However, culling can be managed in a manner that causes minimum impact to non-target species. This is primarily because of the speed at which a culling operation can be implemented (when compared to nest removal). In the case of culling, the scale of the impact is wide (throughout the colony as the culling team advances) but the duration is relatively short (only during the cull and pick-up period). During the intervening periods there is no disturbance within the colony. When removing nests with forestry poles the scale of the disturbance is small (limited to the immediate area of the nest-removers) but the duration is long as it takes many hours/days to remove substantial numbers of nests.

Careful application of management techniques can mitigate many of the potential effects on non-target species. In the case of culling, methods used in 2004 during the management program to minimize disturbance to the non-target heron species included altering: muzzle direction (to reduce noise), duration of shooting events (at least two hours between events at a particular location), and method of collection of culled cormorants (all culled birds were collected at the end of the day, using additional staff and an all terrain vehicle to reduce the duration of disturbance within the woodlands).

The most significant benefit of culling is that it results in reduced numbers of adult birds, which has the greatest beneficial effect on vegetation health. These impacts are not just immediate, but long-term as well since future reproduction and recruitment associated with the culled individuals is also eliminated.

The limited observations made in 2004 suggest there were no significant effects on the GBHE and GREG populations as a result of roost disturbance. Throughout the 2004 project period staff frequently saw GBHE foraging on High Bluff Island. These birds were seen feeding on fish regurgitate (produced by tree-nesting cormorants) and meadow voles *(Microtus pennsylvannicus)*. It is possible that some of the GBHEs observed departing High Bluff Island after roost disturbance activity were heading elsewhere to roost after foraging on High Bluff Island. Further observations throughout the roosting season will better illustrate the importance of the Presqu'ile Islands as a roosting and feeding location for herons in the late-summer and autumn.

The site chosen for artificial ground-nest habitat creation was not ideal and was not used in 2004. A second site will be monitored in 2005 to determine if this method is successful in attracting cormorants.

Vegetation Monitoring / Management

Vegetation assessment has been completed within the High Bluff Island woodlands to determine woodland health, and will continue as part of the strategy (Carr and Koh, 2001; Koh and Carr, 2003). To date, these assessments conclude that the physical activity of cormorant nesting, combined with the soil chemistry changes as a result of guano produced by tree-nesting cormorants, has drastically reduced the health of the woodlands. Assessment in 2000 indicated that severe damage was largely restricted to the larger, super-canopy trees; however, by 2002 the damage had spread to the mid-canopy trees. The spread of damage through the canopy coincided with the increases in nesting activity at the lower canopy level. The health of the western woodland had further declined in 2004 (S. Koh, pers. comm.). Protection of all levels of vegetation within the woodlands is critical to woodland health. Protection of the mature canopy trees is essential as they are the seed trees for new growth.

Trees are long lived and it is too early to determine if there has been a response of the vegetation on High Bluff Island to cormorant management. In addition to cormorant management, native tree species were planted on High Bluff Island and measures are being taken to protect trees and other woody vegetation from damage by deer browse, another stressor on the woodlands.

Non-target Species Monitoring

In 2004, intense data collection re-affirmed the 2003 observation that breeding colonies are enormously dynamic. Two of the non-target heron species, GBHE and GREG, continue to expand their numbers on High Bluff Island. The third non-target heron species, BCNH, had a reduced number of nests in 2004 from the two previous years, however this may not be significant compared to historical records at this site. It is also important to note that BCNH populations have been extirpated from many locations after the loss of suitable nesting habitat due to the effects of nesting cormorants (C. Weseloh, pers. comm.). This scenario is possible on the Presqu'ile Islands if cormorant populations are not managed.

The five colonial ground-nesting species continue to do well and appear unaffected by management activities.

Companion Science

The culled cormorants that had been banded at Presqu'ile were culled late in the cull period, and since they were younger than the birds banded elsewhere, this may indicate that younger, less experienced birds were beginning to take the place of older birds that had been culled. The average age of banded birds suggests that the majority of the cormorants culled at Presqu'ile were mature adults. Results of other companion science studies are pending.

References

Blaney, S.C.. 1997. Checklist of the Vascular Plants of Presqu'ile Provincial Park. Unpublished report prepared for the Ontario Ministry of Natural Resources. 40 pp.

Carr, L.W. and Koh, S. 2001. Preliminary Assessment of Vegetative Damage by the Double-crested Cormorant, Western Forest, High Bluff Island, Presqu'ile Provincial Park. TerraSystems Research. Toronto, Canada. 25 pp.

Koh, S. and L.W. Carr. 2003. Follow-up Assessment of Tree Damage: Effect of Double-crested Cormorants on the Western Forest, High Bluff Island, Presqu'ile Provincial Park. Terra Systems Research. Toronto, Canada. 27 pp.

Koh, S. 2004. Personal communication.

Ontario Parks. 2000a. Double-crested Cormorants at Presqu'ile Provincial Park: an analysis of their effects. Ontario Ministry of Natural Resources. 38 pp.

Ontario Parks. 2000b. Presqu'ile Provincial Park Management Plan. Ontario Ministry of Natural Resources. 36 pp.

Ontario Parks. 2002. Management Strategy for Double-crested Cormorants. Ontario Ministry of Natural Resources. 20 pp.

Ontario Parks. 2004. Annual Report on the Management of Double-crested Cormorants for 2003. Ontario Ministry of Natural Resources. 13 pp.

Weseloh, C. 2004. Person communication.

Weseloh, D.V., P.J. Ewins,J. Struger, P. Mineau, C.A. Bishop, S. Postupalsky and J.P. Ludwig. 1995. Double-crested Cormorants of the Great Lakes: Changes in population size, breeding distribution and reproductive output between 1913 and 1991. Colonial Waterbirds 18 (Special Publication 1): 48-59

Appendix 1. A summary of colonial waterbirds, excluding cormorants, that have bred on High Bluff Island and Gull Island at Presqu'ile Provincial Park. Common names, 4-letter species codes, Latin names and S-ranks from the NHIC* and comments are included for each species.

Black-crowned Night-Heron (BCNH)
Nycticorax nycticorax S3
BCNH have nested at Presqu'ile since 1962 and nest numbers have ranged from 15 to 80. Nesting locations are limited due to tree mortality and loss of nesting habitat. In 2004, a total of 59 Black-crowned Night-Heron nests was counted (7 on Gull Island and 52 on High Bluff Island).

Caspian Tern (CATE)
Sterna caspia S3
CATE populations at Presqu'ile have gone from ten nests in the mid-1980s to 1002 nests in June 2003 (CWS). On June 01, 2004 CWS staff counted 980 nests.

Common Tern (COTE)
Sterna hirundo S4
COTE was the most abundant colonial waterbird nesting at Presqu'ile during the 1960's. From a population once estimated at 10,000 pairs, it declined dramatically in the early 1970's. Since the decline the CMTE population typically establishes up to 150 nests. In 2004, a total of 131 nests was counted on June 06. A later count on July 06 revealed 168 nests. It is possible that 2004's extremely wet weather resulted in the failure of the earlier nests and resulted in a second, later nesting attempt.

Great Blue Heron (GBHE)
Ardea herodias S5
In 1998 GBHE's started nesting on the western shore of High Bluff Island (a single nest). In 2004, a total of 38 successful GBHE nests were found on High Bluff Island and a minimum of 75 chicks fledged.

Great Black-backed Gull (GBBG)
Larus marinus S2
Typically marine, the GBBG also nests at Presqu'ile. The Presqu'ile colony is one of the first known nesting locations on the Great Lakes with the first nest having been discovered in 1962. In 2004, one pair were found nesting on Gull Island with 2 chicks that successfully fledged. A second GBBG nest on High Bluff Island successfully fledged two additional chicks.

Great Egret (GREG)
Casmerodius albus S2
The first breeding record for Presqu'ile was a single nest in May 1999 on High Bluff Island. In 2003, five active GREG nests were counted. All nests were located in shrubby vegetation. In 2004, a total of 10 GREG nests produced 26 young. These birds were observed to have made 29 nesting attempts, 10 of which proved to ultimately be successful. In 2004, High Bluff Island is the only known location on Lake Ontario where GREGs successfully fledged young.

*NHIC: Natural Heritage Information Centre, Provincial Ranking System
S1 Extremely rare, S2 Very rare, S3 Rare to uncommon, S4 Common, S5 Very common

Appendix 1 continued;

Herring Gull (HEGU)
Larus argentatus S5
The HEGU is the second most abundant gull species at Presqu'ile. 271 HEGU nests were counted in 2004. Numerous chicks were observed on the islands in the 2004 breeding season.

Ring-billed Gull (RBGU)
Larus delarawarensis S5
The RBGU is the most abundant colonial waterbird at Presqu'ile. From an initial discovery of 10 nests in 1948, the park's colonies grew to a peak population of 69,417 nests in 1990. In 1999, when the population was last tallied, it consisted of 55,699 nests. Numerous chicks were seen throughout the management program in 2004.

Appendix 2. Weights and Sex of Cormorants Culled on June 07/04

Batch A	Weight	Sex
1	1.92	M
2	2.34	M
3	2.08	M
4	2.00	M
5	2.32	M
6	2.18	M
7	1.99	M
8	1.94	F
9	2.21	M
10	1.88	F

Batch B	Weight	Sex
1	1.92	M
2	2.18	M
3	2.28	M
4	2.00	M
5	1.86	F
6	2.02	M
7	1.91	M
8	1.86	M
9	2.10	M
10	1.50	M

Batch C	Weight	Sex
1	1.74	F
2	1.90	F
3	2.04	M
4	2.00	F
5	2.21	M
6	2.23	M
7	2.11	M
8	1.81	M
9	1.85	M
10	2.13	M

Batch D	Weight	Sex
1	1.94	M
2	2.26	M
3	2.04	M
4	1.08	F
5	2.19	M
6	2.02	M
7	1.76	M
8	2.08	M
9	1.53	F
10	1.93	M

Batch E	Weight	Sex
1	1.96	M
2	1.86	F
3	2.18	F
4	2.02	M
5	1.97	M
6	2.00	M
7	2.07	M
8	2.01	M
9	2.09	M
10	1.81	F

Batch H	Weight	Sex
1	2.14	M
2	2.03	M
3	1.70	F
4	2.02	M
5	1.98	M
6	1.97	M
7	2.02	M
8	1.98	M
9	2.25	M
10	1.88	M

Batch I	Weight	Sex
1	1.99	M
2	2.10	F
3	2.04	M
4	1.8	F
5	2.08	M
6	2.04	M
7	1.89	F
8	2.05	M
9	1.86	M
10	2.04	M

Batch J	Weight	Sex
1	1.78	M
2	1.86	M
3	2.23	M
4	1.92	F
5	2.26	M
6	1.94	M
7	1.96	M
8	2.16	M
9	1.86	F
10	1.92	M

Batch K	Weight	Sex
1	1.96	M
2	2.11	M
3	1.86	F
4	1.98	M
5	1.79	F
6	1.99	F
7	2.07	M
8	1.79	F
9	1.68	F
10	1.86	F

Batch L	Weight	Sex
1	1.88	M
2	1.89	F
3	1.95	F
4	2.07	M
5	1.89	F
6	2.07	M
7	1.80	F
8	2.12	M
9	1.96	M
10	2.14	M

Batch O	Weight	Sex
1	2.00	M
2	1.93	M
3	1.91	F
4	2.05	M
5	2.06	M
6	2.02	M
7	1.87	F
8	1.95	M
9	1.71	F
10	1.91	M

Batch P	Weight	Sex
1	2.13	M
2	2.18	M
3	1.86	F
4	2.11	M
5	2.02	M
6	2.08	M
7	2.04	M
8	1.72	F
9	2.01	M
10	1.98	M

Batch Q	Weight	Sex
1	2.06	M
2	2.10	M
3	2.15	M
4	2.18	M
5	2.17	M
6	1.94	M
7	2.04	M
8	1.92	M
9	1.99	M
10	2.08	M

Batch R	Weight	Sex
1	2.11	M
2	1.89	F
3	2.02	M
4	1.76	F
5	2.04	M
6	1.96	M
7	2.24	M
8	1.93	M
9	1.60	F
10	1.92	M

Batch S	Weight	Sex
1	2.18	M
2	1.96	M
3	1.95	M
4	1.80	F
5	2.29	M
6	2.10	M
7	1.92	F
8	2.02	M
9	2.23	M
10	1.74	F

Batch T	Weight	Sex
1	2.22	M
2	1.68	F
3	1.74	F
4	1.81	F
5	2.26	M
6	2.12	F
7	2.05	F
8	1.87	F
9	2.10	F
10	2.26	F

Batch U	Weight	Sex
1	1.84	M
2	2.12	M
3	1.92	M
4	2.00	M
5	1.86	M
6	1.84	F
7	2.12	M
8	2.02	M
9	2.04	M
10	2.00	M

Batch V	Weight	Sex
1	1.58	F
2	1.98	M
3	1.99	M
4	1.95	F
5	1.98	M
6	1.93	M
7	1.97	F
8	1.62	F
9	2.06	M
10	1.70	M

Batch W	Weight	Sex
1	2.10	M
2	2.18	M
3	2.14	M
4	2.08	M
5	2.05	M
6	1.92	M
7	1.92	M
8	1.62	F
9	2.18	M
10	1.92	M

Batch X	Weight	Sex
1	2.21	M
2	1.70	F
3	1.82	F
4	2.01	M
5	1.75	F
6	2.23	M
7	2.04	M
8	2.03	M
9	2.12	M
10	1.86	F

Batch F	Weight	Sex
1	2.11	M
2	2.00	F
3	1.68	F
4	2.11	M
5	2.20	M
6	1.84	M
7	1.82	M
8	1.84	M
9	1.90	M
10	2.05	M

Batch G	Weight	Sex
1	2.00	M
2	2.14	M
3	2.06	M
4	2.11	M
5	2.10	M
6	1.97	M
7	2.18	M
8	2.00	M
9	2.12	M
10	1.97	M

Batch M	Weight	Sex
1	1.98	M
2	2.26	M
3	2.10	M
4	1.87	M
5	1.96	M
6	2.25	M
7	1.95	M
8	1.72	F
9	1.92	M
10	1.94	F

Batch N	Weight	Sex
1	1.86	M
2	2.28	M
3	2.24	M
4	1.92	F
5	2.10	M
6	2.32	M
7	1.86	M
8	1.96	M
9	1.97	M
10	1.90	M

Batch Y	Weight	Sex
1	2.16	M
2	1.98	M
3	2.12	M
4	2.01	M
5	2.08	M
6	1.83	F
7	1.93	M
8	1.74	F
9	1.74	F
10	1.91	F

Batch AA	Weight	Sex
1	2.16	N/A
2	2.10	N/A
3	2.14	N/A
4	1.88	N/A
5	2.18	N/A
6	1.96	N/A
7	1.94	N/A
8	2.07	N/A
9	1.94	N/A
10	2.01	N/A

Batch Z	Weight	Sex
1	2.28	M
2	2.28	M
3	2.14	M
4	2.06	M
5	1.94	M
6	1.80	F
7	1.88	F
8	2.10	M
9	2.22	M
10	1.78	F

Appendix 3. Age and Natal Origin Data for Culled Cormorants that were Banded

	Band #	Date banded	Bird Age	Jurisdiction where banded	Latitude	Longitude
1	1247 89460	June 20, 1995	9	Ontario – Lake Huron	46.0	83.1
2	1247 34518	June 19, 1991	13	Ontario – Lake Huron	46.0	83.0
3	1137 85347	June 20, 1995	9	Ontario – Lake Huron	46.0	83.0
4	1247 85871	June 21, 1995	9	Ontario – Lake Huron	46.0	82.4
5	1227 59597	June 21, 1993	11	Ontario – Lake Huron	46.0	83.1
6	1247 89682	June 20, 1995	9	Ontario – Lake Huron	46.0	83.0
7	0767 82310	June 23, 1995	9	Ontario – Lake Huron	46.0	83.1
8	0978 77126	July 23, 2002	2	Ontario – Lake Ontario	43.5	77.4
9	0868 92424	June 26, 2000	4	Ontario – Lake Ontario	43.5	77.4
10	0868 92372	June 26, 2000	4	Ontario – Lake Ontario	43.5	77.4
11	0978 78060	July 31, 2003	1	Ontario – Lake Ontario	43.5	77.4
12	1247 88798	June 22, 1994	10	Michigan – Lake Huron	45.5	84.0
13	1247 87423	June 18, 1994	10	Michigan – Lake Michigan	45.4	86.4
14	1247 66246	June 02, 1995	9	Michigan – Lake Michigan	45.4	85.5
15	0878 07716	July 18, 1995	9	Wisconsin – Lake Michigan	45.1	86.5
16	878 09671	July 22, 1996	8	Wisconsin – Lake Michigan	45.1	86.5
17	0837 61667	June 30, 1988	16	Wisconsin – Lake Michigan	45.1	86.5
18	0848 93823	July 28, 1995	9	New York – Lake Champlain	44.4	73.2